RADIOACTIVITY MAP OF VERMONT 1980 (File no. 1980-1, rev. 3)

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**NOTE**: This text accompanies the "Radioactivity Map of Vermont" and the "Overlay Addendum to Radioactivity Map of Vermont."
INTRODUCTION

The Radioactivity Map of Vermont is a compilation map that includes areas that display anomalously high radioactivity detected by aerial and ground surveys, and the locations of known uranium occurrences where analytical information is available. These sites are located on the Vermont Town-County map (Appendix A), and corresponding analytical data is presented in Appendix B.

RADIOACTIVITY

Anomalously high radioactivity is associated with all geologic terranes in Vermont, for example, igneous granitics at Ascutney, Precambrian crystallines at Jamaica and Okemo Mt., Paleozoic crystallines at the Udall mine in Wolcott, Paleozoic carbonates at Milton and Highgate, and Pleistocene to Recent gravels reported at Cuttingsville and occurrences in the Glens Falls, Albany and Lewiston NTMS 1° x 2° hydrogeochemical and stream sediment reports by NURE.

URANIUM OCCURRENCES

Uranium occurs in a variety of minerals and geologic settings in each of the terranes where samples have been collected and analyzed.

In the Precambrian crystalline terrane uranium mineralization is found in discontinuous veins in quartzites and gneissic quartzites, in tourmaline-bearing pegmatites, in coarse-textured migmatite (recrystallized pegmatite), and in biotite-rich zones in mica schist.

Uranium minerals occur largely as intergranular disseminations in "spotty" or "patchy" accumulations along shear and fracture surfaces, along foliation surfaces, or filling intergranular space in coarse-textured occurrences.

Pitchblende is the main uranium-bearing substance. Secondary uranium minerals and allanite and zircon are also reported. Associate minerals are graphite, pyrite, garnet and blue quartz. Iron oxide staining is commonly associated with uranium occurrences.

At the Udall mine in Wolcott (Paleozoic crystalline terrane) uraninite is associated with pyrite and chalcopyrite in a small strata-bound sulfide deposit.

Uranium replaces calcium in fluorapatite (hydroxylapatite) in the intraformational breccias of the Clarendon Springs dolomite in the Highgate-Milton area.

Uranium in stream sediments of Pleistocene and recent origin apparently is associated with resistate minerals such as zircon and monazite. No attempt has been made to locate stream sediment sites showing anomalously high uranium content. The uranium content in stream sediments is seldom greater than 75 ppm and most commonly is less than 10 ppm. Detailed maps are available in the NURE hydrogeochemical-stream sediment reports (see reference list).

The apparent proliferation of uranium occurrences and anomalous radioactivity in southern Vermont is due only to the fact that the greatest efforts to locate uranium occurrences have concentrated on this area. Also perhaps the most promising uranium occurrences have been located in Vermont's Precambrian terrane, exposures of which are restricted to the southern and central part of the state.
POTENTIAL FOR URANIUM ORE DEPOSITS

Whether or not a mineral occurrence becomes a mineable ore deposit depends on several factors. Among the most important factors are ore grade or the quality of mineralization, the proven tonnage or quantity of concentrated ore minerals, and the monetary value placed on each pound of ore. Other factors such as geographic accessibility, nearness to processing facilities and markets, and geologic occurrence of the ore mineral are strong determinants in making the decision to mine or not to mine.

The Schwartzwalder mine in Jefferson County, Colorado is a vein-type occurrence in a Precambrian crystalline terrane. On the surface, uranium mineralization is expressed by the occurrence of iron oxide staining and presence of secondary uranium minerals. Readings as high as 7000 cps (counts per second) were recorded on an exploration scintillometer at the surface. Pitchblende ores range from .17% to 58% U₃O₈. For every foot of rock that has been core drilled, approximately 100 pounds of U₃O₈ has been discovered. The mine is currently 4430 feet deep, and several thousand feet of rock core has been drilled. In Vermont's Precambrian terrane, one sample collected at the surface (Okemo) shows a U₃O₈ analyses of 5300 ppm or approximately .5%. No core drilling has occurred which would test the quality and quantity of uranium mineralization at depth.

In Colorado, Utah and Wyoming much of the uranium mineralization occurs in relatively soft, sedimentary sandstones. The ease of accessibility, the massive open pit mining methods, and the large tonnages of mineralized rock make it possible to consider grades as low as .05%. No comparable geologic occurrence exists in Vermont. The closest similarity might be the uranium mineralization in the Clarendon Springs dolomite. There has been insufficient exploration core drilling to determine either the grade or extent of mineralization in this geologic setting.
APPENDIX B

Uranium Occurrence Localities
and
Analytical Data

BENNINGTON COUNTY (see page 9)

9. Snow Mountain, Winhall, VT (Grauch and Zarinski, 1976, Location Nos. 1a and 1b in their report):
   $U_3O_8 = 0.1\%$
   
   also Deposit No. 29 in Appendix C of McHone and Wagener, 1980:
   $U_3O_8 = 60$ ppm
   
   also Deposit No. 30 in Appendix C of McHone and Wagener, 1980:
   $U_3O_8 = 72.5$ ppm

21. East Kansas occurrence, Sunderland, VT (McHone and Wagener, 1980, Deposit No. 31 in their Appendix C):
   $U_3O_8 = 158$ ppm
   $UO_2 = 1350$ ppm

23. Peru, VT (McHone and Wagener, 1980, Sample No. MHL 009 in their Appendix B):
   $U_3O_8 = 18$ ppm

CHITTENDEN COUNTY

4. Turgeon Farm (Dunham Dolomite, Clarendon Springs Formation (?)), Milton, VT (Grauch and Zarinski, 1976, Location No. 2 in their report):
   $U_3O_8 = 0.018\%$
   
   also Lucius Pitkin, Inc., 1975, lab no. RD-43:
   $U_3O_8 = 0.04\%, eU_3O_8 = 0.07\%, ThO_2 = 9$ ppm

8. Near Milton, VT (McKeown, 1951, table 3):
   $eU(%) = .022$, Uranium $(%) = .019$ (highest % of samples taken)

FRANKLIN COUNTY

3. Roland Fortin Farm (Clarendon Springs Formation), Highgate Springs, VT (Lucius Pitkin, Inc., 1975, lab no. RD-41):
   $U_3O_8 = 317$ ppm, $ThO_2 = 34$ ppm
   
   also Rio Tinto Canadian Exploration, Ltd., 1972:
   $U_3O_8 = .46$ lbs/ton (highest amount of samples taken)
   
   also Grauch and Zarinski, 1976, Location No. 4 in their report:
   $U = 0.032\%$

10. Berkshire Copper Mine, Berkshire, VT (Grauch and Zarinski, 1976, Location No. 3 in their report): No analytical data available.

LAMOILLE COUNTY

   $%U_3O_8e = 0.06$, $%U_3O_8c = 0.06$

11. Eden, VT (Grauch and Zarinski, 1976, Location No. 5 in their report):
    No analytical data available.

con't
con't LAMOILLE COUNTY

12. Johnson Talc Mine, Johnson, VT (Grauch and Zarinski, 1976, Location No. 6 in their report): No analytical data available.

ORANGE COUNTY

13. East Braintree Arsenic Mine, East Braintree, VT (Grauch and Zarinski, 1976, Location No. 8 in their report): No analytical data available.

35. Chelsea, VT (McHone and Wagener, 1980, Sample No. MHL 029 in their Appendix B):
   $U_3O_8 = 3$ ppm

RUTLAND COUNTY

7. Cuttingsville, VT, quartz-pyrite fracture filling associated with the syenite stock at or near Granite Hill (Anaconda Copper Co., 1978):
   $U_3O_8 = 25$ ppm, 27 ppm, 53 ppm, 45 ppm
   also McHone and Wagener, 1980, Sample Nos. MHL 021, 051, and 401 in their Appendix B:
   $U_3O_8 = 9$ ppm, Sample No. MHL 201
   $U_3O_8 = 16$ ppm, Sample No. MHL 051
   $U_3O_8 = 2$ ppm, Sample No. MHL 401

14. Tweed River Mine, Sherburne Center, VT (Grauch and Zarinski, 1976, Location No. 10 in their report): No analytical data available.

15. Allen Mica Mine, Sherburne, VT (McHone and Wagener, 1980, Deposit No. 16 in their Appendix C):
   $U_3O_8 = 390$ ppm

16. Uranium Prospect, Mt. Tabor, VT (near Devil's Den) (Grauch and Zarinski, 1976, Location No. 11 in their report): No analytical data available.

19. Castleton anomaly, Castleton, VT (McHone and Wagener, 1980, Deposit No. 15 in their Appendix C):
   $U_3O_8 = 150$ ppm
   $U_3O_8 = 65$ ppm

28. Clarendon, VT (McHone and Wagener, 1980, Sample No. MHL 022 in their Appendix B):
   $U_3O_8 = 3$ ppm

29. Sherburne, VT (McHone and Wagener, 1980, Sample No. MHL 023 in their Appendix B):
   $U_3O_8 = 12$ ppm

30. Mendon, VT (McHone and Wagener, 1980, Sample No. MHL 001 in their Appendix B):
    $Y_3O_8 = 14$ ppm

31. Sherburne, VT (McHone and Wagener, 1980, Sample No. MHL 002 in their Appendix B):
    $U_3O_8 = 11$ ppm.

con't
con't RUTLAND COUNTY

32. Chittenden, VT (McHone and Wagener, 1980, Sample No. MHL 033 in their Appendix B):
   \( U_3O_8 = 18 \) ppm

33. Proctor, VT (McHone and Wagener, 1980, Sample No. MHL 066 in their Appendix B):
   \( U_3O_8 = 6 \) ppm

34. Brandon, VT (McHone and Wagener, 1980, Sample No. MHL 034 in their Appendix B):
   \( U_3O_8 = 16 \) ppm

36. Fair Haven, VT (McHone and Wagener, 1980, Sample No. MHL 058 in their Appendix B):
   \( U_3O_3 = 3 \) ppm

37. Poultney, VT (McHone and Wagener, 1980, Sample No. MHL 075 in their Appendix B):
   \( U_3O_8 = 1 \) ppm

WINDHAM COUNTY (see page 9)

   \( Th \) ppmw = \( \angle 0.02 \), \( Th \) ppmw = \( \angle 0.2 \), \( U \) ppmw = \( \angle 0.02 \), \( U \) ppmw = \( \angle 0.2 \).

   Also Appendix C of McHone and Wagener, 1980 (includes two red cross-hatched areas just east and west of Jamaica), their Deposit Nos. 32-36:

   \( U_3O_8 = 578 \) ppm, Deposit No. 32
   \( U_3O_3 = 325 \) ppm, Deposit No. 32
   \( U_3O_8 = 710 \) ppm, Deposit No. 32
   \( U_3O_8 = 403 \) ppm, Deposit No. 33
   \( U_3O_8 = 42 \) ppm, Deposit No. 34
   \( U_3O_8 = 41 \) ppm, Deposit No. 34
   \( U_3O_8 = 5 \) ppm, Deposit No. 34
   \( U_3O_8 = 19 \) ppm, Deposit No. 34
   \( U_3O_8 = 255 \) ppm, Deposit No. 35
   \( U_3O_8 = 295 \) ppm, Deposit No. 35
   \( U_3O_8 = 36 \) ppm, Deposit No. 36

   Also Appendix C of McHone and Wagener, 1980 (includes two red cross-hatched areas just east and west of Jamaica), their Deposit Nos. 32-36:

   \( The \) Pinnacle
   \( Little \) Turkey \( Mtn. \)
   \( East \) Jamaica
   \( Wardsboro \) Brook

22. West Jamaica occurrence, Jamaica, VT (McHone and Wagener, 1980, Deposit No. 37 in their Appendix C):
   \( U_3O_8 = 21 \) ppm

WINDSOR COUNTY

5. Okemo Mountain area, Ludlow, VT (Skyline Lab report, 1980):
   \( U \)-assay (%): Grant Brook, elev. 2040' = .075 and .06, top of Okemo Mtn. east of fire tower = .397
Con't Windsor County

also Appendix C of McHone and Wagener, 1980 (includes all points in red cross-hatched area just west of Ludlow), their Deposit Nos. 17-27:
\[
\begin{align*}
U_3O_8 &= 210 \text{ ppm}, \text{ Deposit No. 17} \\
U_3O_8 &= 300 \text{ ppm}, \text{ Deposit No. 18} \\
U_3O_8 &= 124 \text{ ppm}, \text{ Deposit No. 19} \\
U_3O_8 &= 325 \text{ ppm}, \text{ Deposit No. 20} \\
U_3O_8 &= 1540 \text{ ppm}, \text{ Deposit No. 21} \\
U_3O_8 &= 805 \text{ ppm}, \text{ Deposit No. 21} \\
U_3O_8 &= 137 \text{ ppm}, \text{ Deposit No. 22} \\
U_3O_8 &= 5300 \text{ ppm}, \text{ Deposit No. 23} \\
U_3O_8 &= 47 \text{ ppm}, \text{ Deposit No. 23} \\
U_3O_8 &= 230 \text{ ppm}, \text{ Deposit No. 24} \\
U_3O_8 &= 188 \text{ ppm}, \text{ Deposit No. 25} \\
U_3O_8 &= 342 \text{ ppm}, \text{ Deposit No. 25} \\
U_3O_8 &= 214 \text{ ppm}, \text{ Deposit No. 25} \\
U_3O_8 &= 318 \text{ ppm}, \text{ Deposit No. 25} \\
U_3O_8 &= 525 \text{ ppm}, \text{ Deposit No. 26} \\
U_3O_8 &= 313 \text{ ppm}, \text{ Deposit No. 26} \\
U_3O_8 &= 10 \text{ ppm}, \text{ Deposit No. 26} \\
U_3O_8 &= 360 \text{ ppm}, \text{ Deposit No. 26} \\
U_3O_8 &= 93 \text{ ppm}, \text{ Deposit No. 26} \\
U_3O_8 &= 460 \text{ ppm}, \text{ Deposit No. 27}
\end{align*}
\]

\[
U_3O_8 = 0.53\%, \text{ ThO}_2 = 13.8\%
\]

17. Chester Mica Prospect, Chester, VT (Grauch and Zarinski, 1976, Location No. 12 in their report): No analytical data available.

18. Soapstone Quarry, Ludlow, VT (Grauch and Zarinski, 1976, Location No. 13 in their report): No analytical data available.

20. Perkinsville anomaly, Weathersfield, VT (McHone and Wagener, 1980, Deposit No. 28 in their Appendix C):
\[
U_3O_8 = 27.5 \text{ ppm}
\]

Con't
con't WINDSOR COUNTY

24. Chester, VT (McHone and Wagener, 1980, Sample No. MHL 012 in their Appendix B):
   \[ U_3O_8 = 9 \text{ ppm} \]

25. Chester, VT (McHone and Wagener, 1980, Sample No. MHL 013 in their Appendix B):
   \[ U_3O_8 = 4 \text{ ppm} \]

26. Windsor, VT (McHone and Wagener, 1980, Sample Nos. MHL 068-071 in their Appendix B):
   \[ U_3O_8 = 3 \text{ ppm, Sample No. MHL 068} \]
   \[ U_3O_8 = 4 \text{ ppm, Sample No. MHL 069} \]
   \[ U_3O_8 = 7 \text{ ppm, Sample No. MHL 070} \]
   \[ U_3O_8 = 1 \text{ ppm, Sample No. MHL 071} \]

27. Weston, VT (McHone and Wagener, 1980, Sample No. MHL 406 in their Appendix B):
   \[ U_3O_8 = 19 \text{ ppm} \]
BENNINGTON COUNTY

38. Searsburg, VT (Field and Truesdell, 1980, this figure is the highest of 7 in the immediate area of point 28; information from their Appendix B and Plate 9): 
   \( U_3O_8 = 128 \text{ ppm} \)

39. Searsburg, VT (Field and Truesdell, 1980, this figure is the highest of 14 in the immediate area of point 29; information from their Appendix B and Plate 9): 
   \( U_3O_8 = 96 \text{ ppm} \)

40. Woodford, VT (Field and Truesdell, 1980, this figure is the highest of 4 in the immediate area of point 30; information from their Appendix B and Plate 9): 
   \( U_3O_8 = 39 \text{ ppm} \)

41. Woodford, VT (Field and Truesdell, 1980, this figure is the highest of 15 in the immediate area of point 31; information from their Appendix B and Plate 9): 
   \( U_3O_8 = 3,217 \text{ ppm} \)

42. Pownal, VT (Field and Truesdell, 1980, this figure is the highest of 2 in the immediate area of point 32; information from their Appendix B and Plate 9): 
   \( U_3O_8 = 5.5 \text{ ppm} \)

WINDHAM COUNTY

43. Wilmington, VT (Field & Truesdell, 1980, Sample No. MHG 092, from Appendix B and Plate 5 in their report): 
   \( U_3O_8 = 1 \text{ ppm} \)

44. Dummerston, VT (Field and Truesdell, 1980, Sample No. MHG 250, from Appendix B and Plate 5 in their report): 
   \( U_3O_8 = 3.1 \text{ ppm} \)

45. Somerset, VT (Field and Truesdell, 1980, this figure is the highest of 2 in the immediate area of point 35; information from their Appendix B and Plate 9): 
   \( U_3O_8 = 17 \text{ ppm} \)
Anaconda Copper Co., 1978, report made available to the State Geologist from Anaconda Copper Co., report available at the State Geologist's Office, Montpelier, VT.

Canadian Dept. of Mines (analyzed by), 1969, Laboratory and Research Branch, Ontario, Canada, report available at the State Geologist's Office, Montpelier, VT.


Lucius Pitkin, Inc., Petrographic-Mineralogical Laboratory (petrographic report for ERDA), 1975, lab no. RD-41, report available at the State Geologist's Office, Montpelier, VT.

Lucius Pitkin, Inc., Petrographic-Mineralogical Laboratory (Petrographic report for ERDA), 1975, lab no. RD-43, report available at the State Geologist's Office, Montpelier, VT.


Rio Tinto Canadian Exploration, Ltd., 1972, report available at the State Geologist's Office, Montpelier, VT.


OVERLAY ADDENDUM TO RADIOACTIVITY MAP OF VERMONT

FIELD + TRUEDELL, 1926, URANIUM RESOURCE EVALUATION - ALBANY QUAD